Theerasak (Beer) Opatsuwan
Preston, United Kingdom
E: beer.opatsuwan@outlook.com
P: +44 7949 312550
LinkedIn: bo033

28 November 2016

Professor Simon Bartlett AM
BE(Hons) BSc FTSE FIE Aust FAICD MIEEE RPEQ CPEng
The University of Queensland, Australia
E.S. Cornwall Scholarship Advisory Committee – Chairperson
Email: simon.bartlett@uq.edu.au

Ref: E.S. Cornwall Scholarship Report for First Quarter (period: June to September 2016)
Research Theme: Asset Management Excellence

Dear Professor Bartlett,

Please find attached my scholarship report for the first quarter of my placement covering the period of June to September 2016. The report provides an insight into my work experience at Electricity North West Limited (ENWL), an electricity distribution company based in the UK. The report covers the key learning through project works, observations, and interviews with leaders across ENWL.

Specifically, the following aspects are covered in the report:

- Introduction to ENWL's business operations and their flagship projects.
- Project work: implementation of the common network asset indices methodology.
- Project work: Asset management of low voltage underground switchboard driven by safety.
- Extra-curricular activities relevant to the scholarship plan.

The work experience has provided me with a unique insight into the UK power industry and broadened my horizons. As previously stated, my mission is to use the knowledge gained to transform Energex and Energy Queensland into a dynamic and world leading distribution network services provider. I am also committed to turning this experience into a great benefit for the broader Australian power community.

On a personal note, the overall experience has been extremely rewarding for my personal growth as it has strengthened my mindset and capacity to lead. On behalf of my family and I, thank you once gain for the scholarship committee's support during this period.

Yours sincerely,

Beer Opatsuwan
MIEAust CPEng NER RPEQ IntPE(Aus) BEng(Hons) GradCertEng
E.S. Cornwall Scholar

electricity north west

Bringing energy to your door

University of Queensland, Australia
E.S. Cornwall Memorial Scholarship

Asset Management Excellence
First Quarter Report
June to September 2016

Beer Opatsuwan

Chartered Professional Electrical Engineer

University of Queensland, Australia

E.S. Cornwall Memorial Scholarship
First Quarter Report
Period of June to September 2016
Research topic: Asset Management Excellence

Prepared by:

Theerasak "Beer" Opatsuwan

Version control:

Version	Description	Date of Issue
0.1	Initial Draft circulated for Comments	20 November 2016
1	Submission to the University of Queensland	28 November 2016

Acknowledgements

I'd like to thank the University of Queensland, Energex Limited, EA Technology Limited (EATL), and Electricity North West Limited (ENWL) for the support provided during the scholarship tenure. Specific thanks to the ENWL's Asset Management Team (Jonathan Booth, Bob Wells, Ian McCormack, Phil McFarlane, Dan Wilson, Jabulani Mpofu, and Ian Fenton) and ENWL's staff at Preston office UK who have contributed to my overall learning during the first quarter of my scholarship placement.

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1. Overview

During the first quarter of my scholarship placement with Electricity North West Limited (ENWL), I have witnessed and learnt many aspects of ENWL's business in operations. The placement has broadened my experience to better understand how a leading asset manager operates and the frameworks which support it. The projects I have been involved with have provide me with significant insights into ENWL from a strategic to an operational level. The core projects I have been involved with are 1) implementation of the Common Network Asset Indices Methodology or CNAIM, and 2) development of an asset management strategy to address the safety issue with low voltage underground link boxes. The anticipated overall programme for my scholarship placement during the first two quarters is illustrated below.

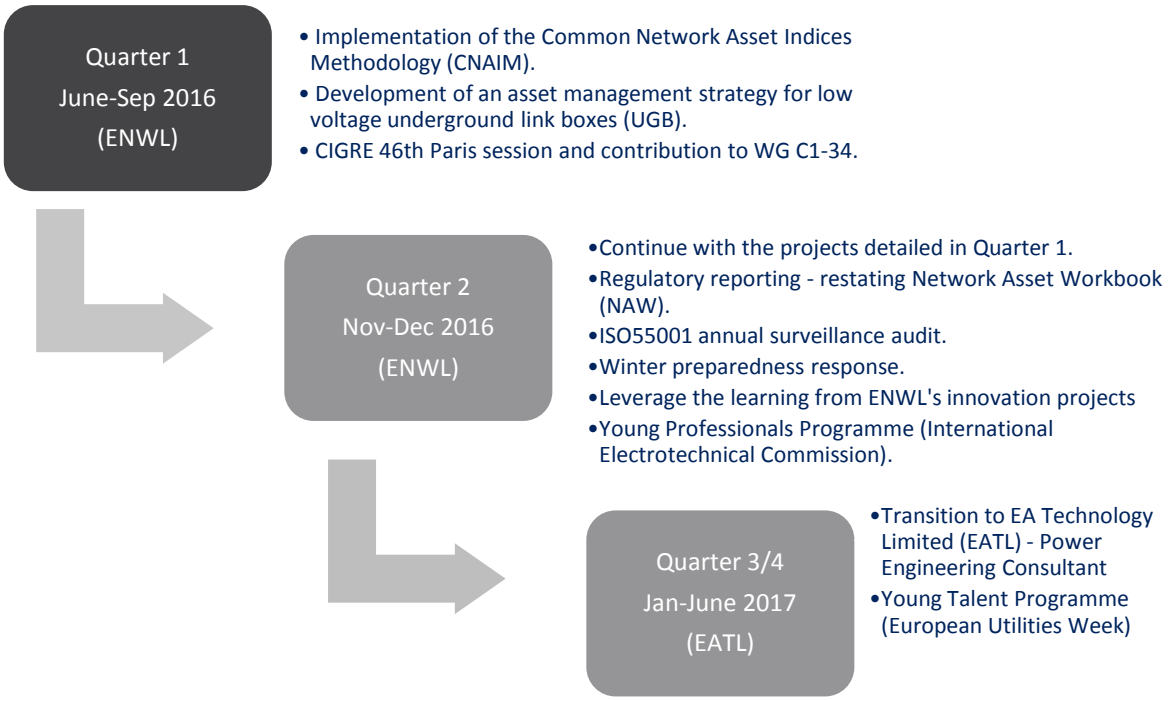


FIGURE 1 - PLANNED SCHOLARSHIP PROGRAMME JUNE 2016 – JUNE 2017

The scope of learnings have covered the following key areas of ENWL's business operation:

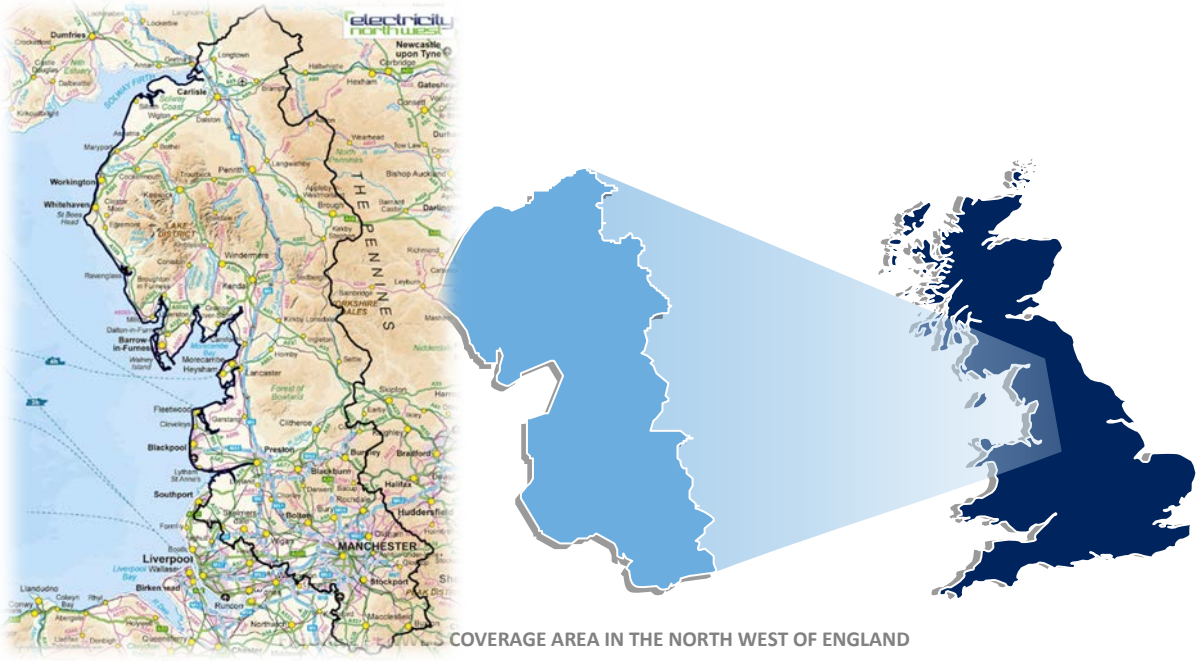
- Asset management strategy and mechanisms to translate it into deliverable plans (business as usual operations).
- Asset management approach to nationwide safety issues.
- UK common frameworks to assess asset health indices and risk for regulatory reporting.
- General business operations including culture, processes, communications and leadership.
- Relationship between ENWL and their external stakeholders.
- Company's transformation through new leadership.

The involvement with the core asset management projects has provided me with a valuable opportunity to deep dive into ENWL's systems and processes. I'd like to formally thank ENWL's Asset management team led by Jonathan Booth for their warm welcome and having hosted me during the first quarter of my scholarship tenure.

2. Electricity North West

2.1. Introduction

Electricity North West Limited (ENWL) is licensed to distribute electricity in the north west of England and is regulated by the Gas and Electricity Markets Authority (GEMA), which operates through the Office of Gas and Electricity Markets (Ofgem). ENWL is a private limited company which is currently owned by a consortium of funds managed by Colonial First State and JPMorgan Asset Management Infrastructure Investments Group. As a guide, about 55% of ENWL's customers live in Greater Manchester, 30% in Lancashire and 10% in Cumbria and the remainder in parts of Cheshire, Derbyshire and North Yorkshire. There are 14 licensed geographically defined areas across the UK based on the former area electricity board boundaries in which the Distribution Network Operators operate. ENWL hold one distribution license (North West region) which makes their electricity network somewhat uniform compared to the other five DNOs which hold multiple distribution licenses. The map of the UK below illustrates the coverage area by ENWL.



COVERAGE AREA IN THE NORTH WEST OF ENGLAND

The key facts about ENWL are detailed below:

Key Statistics	Approximate Figures
Number of customers	2.37 million
Length of underground cables (km)	44,400
Length of overhead cables (km)	10,000
Total units distributed annually (GWh)	23,400
Number of employees (FTEs)	1,700
Area covered (km^2)	12,500
Peak demand (MV.A)	4,250
Asset value (£)	12 million

TABLE 1 - ENWL'S KEY FACTS

Note: the figures above are estimate only and current as at June 2016

2.2. Regulatory Regime

As a Distribution Network Operator, ENWL does not generate or supply electricity. The price which ENWL charges are governed by an eight year regulatory regime known as RIIO-ED1 which commenced in 2015. RIIO is a new approach for sustainable network regulation from 2015 where Revenue = Incentives + Innovation + Outputs. Under the RIIO model there is a much greater emphasis than the previous regimes on companies to develop a more sustainable energy sector and deliver value-for-money network services for customers today and in the future. The outputs act as a contract between DNOs and their customers for DNOs are expected to

deliver. These outputs are reported, measured and benchmarked with other DNOs across the UK by Ofgem on a regular basis. This is unique economic model which has a real potential to drive competition and overall performance within the power industry.

2.3. Company Values

ENWL operates based on six core values to support their vision to be the leading energy delivery business. At the core of their values matrix is the customers supported by high performing staff (people and performance) integrated with safety and an innovation mindset. During the placement, I had an opportunity to better understand how these core values are translated into day to day operations.

2.4. Organisation Structure

ENWL consists of six directorates including Finance, Customer & Business Services, Energy Solutions, Operations North, Operations South and Network Strategy & Technical Services (NTTS) as shown in the organisation chart below. NTTS is unique directorate consisting of varying degree of expertise ranging from regulatory, asset management, IT business support and technical engineering functions.

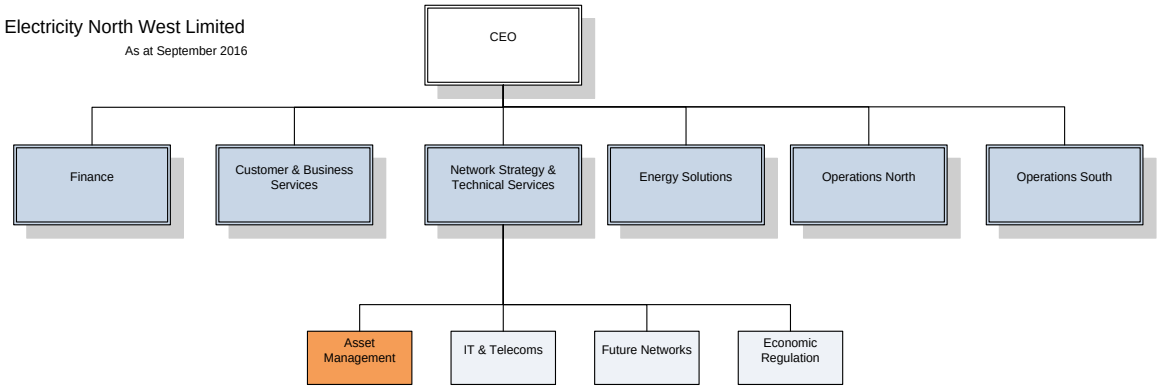


FIGURE 3 - ENWL'S ORGANISATION STRUCTURE AS AT 30 SEPTEMBER 2016

2.5. Asset Management

The Asset Management (AM) business unit falls within the NTTS directorate. AM is a small team led by Jonathan Booth (Head of Asset Management) and consisting of seven managers, each assigned with a distinct responsibility. The structure of ENWL's AM is shown in the diagram below. The core function of AM is to develop and maintain ENWL's asset strategy, data and models that support their assets as well as providing a long-term investment plan to the business. It is a unique business function which has potential to provide plenty of knowledge to young asset managers covering end-to-end spectrum scope of works with particular focus on translating engineering knowledge and asset data into business insights, risks and business investment plans. The lean formation of AM has provided me with a different perspective into the world of asset management as well. Rather than being a large directorate, AM at ENWL is all about integrating the appropriate mindset and discipline into the wider business.

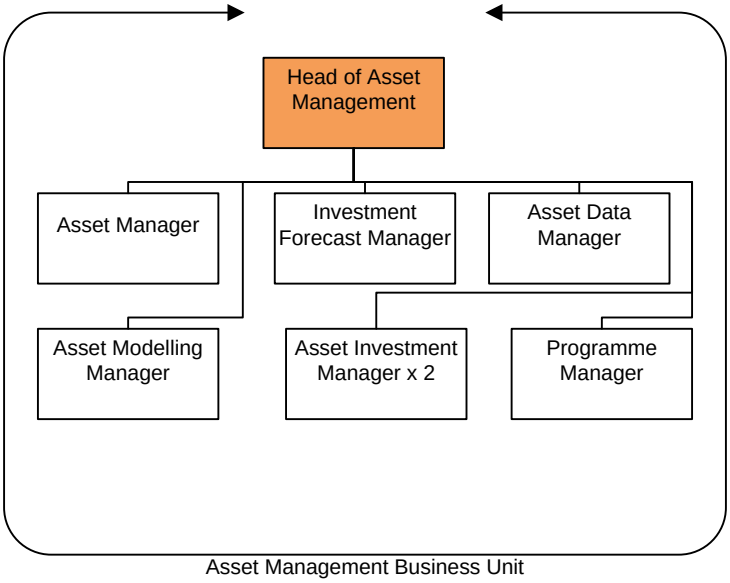


FIGURE 4 - ENWL'S ASSET MANAGEMENT BUSINESS UNIT

The principles of ENWL's asset management are set out in their asset management policy. The policy encompasses the following aspects:

- The network risk to the general public and operators.
- Customers' needs and expectations.
- Value for money and whole of life costs when building the electricity distribution network.
- Best use of the available asset data through the corporate Enterprise Asset Management system (a single source of truth).

In October 2015, ENWL achieved ISO55001 certification in the area of processes, policies, systems and programmes relating to the management of their electricity distribution network. ENWL is due to undergo an annual surveillance audit to maintain their compliance with ISO55001 in October 2016. I envisage that this will be an excellent opportunity for me to gain insights into their asset management framework in practice, understanding the auditor's requirements and what it takes to achieve and sustain success in being a leading asset management organisation.

3. Common Methodology

3.1. Background

Under RIIO-ED1, Ofgem has introduced regulatory reporting requirements for all UK DNOs to report in information relating to asset health and criticality using a common approach. This information is collectively known as the Common Network Asset Indices Methodology (CNAIM). The information provides an indication of the risk of condition based failure of network assets and allows Ofgem to gain a better visibility of asset risks presented in each DNO in comparison to its counterparts.

The requirement is outlined in the electricity distribution license Standard Licence Condition 51 (SLC51) which requires all UK DNOs to jointly develop a common methodology, i.e. to align their approaches into a single approach to deriving asset risks. ENWL took a lead role in the development of CNAIM since 2015 through Ofgem's Reliability working group and other channels. CNAIM sets out the overall process for assessing condition-based risk and specifies the parameters, values and conditions to be used. The collective outputs of the assessment used for regulatory reporting process is known as the Network Asset Indices under CNAIM. As a result of SLC51, all UK DNOs are required to align their current processes and practices with the methodology.

The project will also require a re-basing of the network risk targets to be agreed between DNOs and Ofgem for the RIIO-ED1 period through the restatement of Network Assets Workbook. Effectively, DNOs will be judged on whether they achieve a pre-defined change in the level of asset risks by their investment as measured by the principles of common methodology. For some DNOs, this is seen as an opportunity to effectively renegotiate a new contract with Ofgem since the commencement of RIIO-ED1 in 2015.

CNAIM has been reviewed extensively by stakeholders across the UK power industry and was approved in August 2016. EA Technology Limited (EATL) has been engaged by all UK DNOs to develop a software (the relevant architecture and calculation engine) to enable the industry to report their network asset risks to Ofgem. Ofgem has instructed all UK DNOs to re-base their network risk target by the end of 2016.

3.2. Implementation (phase 1)

ENWL is in the process of commissioning software provided by EATL to enable the relevant asset risk reporting to occur. The project is being led by the Asset Management team based in Preston, UK with support from functions across the business. The project overview is illustrated in the diagram below:

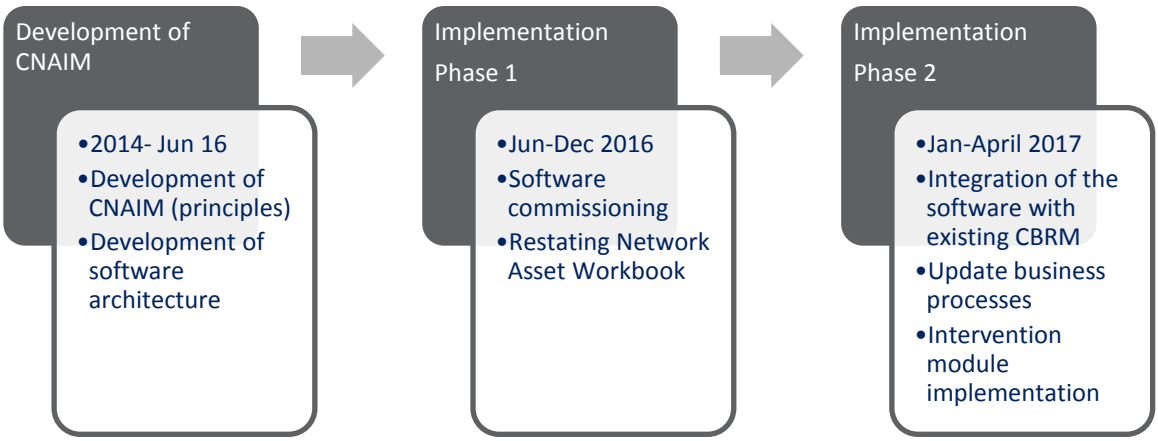


FIGURE 5 - CNAIM PROJECT IMPLEMENTATION PLAN

The project team comprises experts from across divisions including IT specialists, asset managers, power systems consultants, data specialists and regulatory professionals. The experience was an excellent learning opportunity and allows me to deep-dive into the working culture and processes at ENWL.

3.3. Methodology Overview

This section provides a high level overview of principles and processes of CNAIM. The two key outputs from the CNAIM are:

1) An evaluation of the Probability of Failure (PoF) which is the likelihood of condition-based failure per annum for individual assets. The calculations evaluate various parameters (asset specifications, environment, duty, history and conditions) to derive a Health Score (HS) and its relevant Health Index (HI) banding. The HI is then mapped into a PoF using a predefined HI-to-PoF curve agreed by the industry.

2) An evaluation of the Consequences of Failure (CoF) for individual assets. The consequences are briefly described as the impact of failures in terms of an average monetised value (in £) based on financial, safety, environmental and network performance.

The diagram below illustrates the key parameters into the CNAIM, thus producing PoF and CoF as well as the resultant calculated monetised risk (i.e. Risk = PoF x CoF).

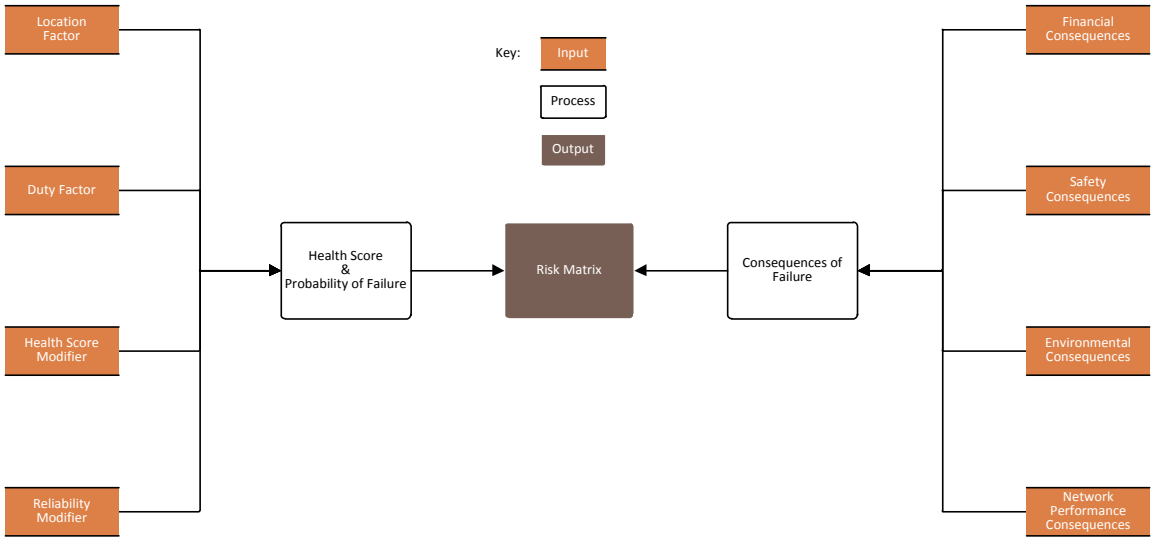


FIGURE 6 - COMMON METHODOLOGY BUILDING BLOCK

3.4. Asset Class

CNAIM applies to a number of different types of assets. The methodology applies the same principles in evaluating PoF and CoF for each asset type. However, the inputs, calculations, and calibrations vary to some degree for all asset types. The development of CNAIM focused on the 25 asset categories within the four main asset class including poles, switchgear, transformer, tower OHL (overhead line) and cables. The breakdown of these asset categories is shown on the table below.

CM	Health Index Asset Category	Asset Class (Generic terms)
1	LV OHL Support	Poles
2	LV UGB	Switchgear
3	LV Switchgear and Other	Switchgear
4	HV OHL Support - Poles	Poles
5	HV Switchgear (GM) - Primary	Switchgear
6	HV Switchgear (GM) - Distribution	Switchgear
7	HV Transformer (GM)	Transformers
8	EHV OHL Support - Poles	Poles
9	EHV OHL Fittings	Tower OHL

CM	Health Index Asset Category	Asset Class (Generic terms)
10	EHV OHL Conductor (Tower Lines)	Tower OHL
11	EHV OHL Support - Towers	Tower OHL
12	EHV UG Cable (Gas)	Cables
13	EHV UG Cable (Non Pressurised)	Cables
14	EHV UG Cable (Oil)	Cables
15	Submarine Cables	Cables
16	EHV Switchgear (GM)	Switchgear
17	EHV Transformer	Transformers
18	132kV OHL Fittings	Tower OHL
19	132kV OHL Conductor (Tower Lines)	Tower OHL
20	132kV OHL Support – Tower	Tower OHL
21	132kV UG Cable (Gas)	Cables
22	132kV UG Cable (Non Pressurised)	Cables
23	132kV UG Cable (Oil)	Cables
24	132kV CBs	Switchgear
25	132kV Transformer	Transformers

TABLE 2 - HEALTH INDEX ASSET CATEGORY AS PER CNAIM

ENWL in the process of commission the software (supplied by EATL) with all the asset categories above excluding CM13, 15, 21 and 22.

3.5. Risk Matrices

Risk matrices are used for the regulatory reporting of asset health and criticality. The matrix is a 5x4 formation covering HI banding (1 to 5) and Consequence banding (1 to 4) providing a snapshot picture of individual asset category for each DNO.

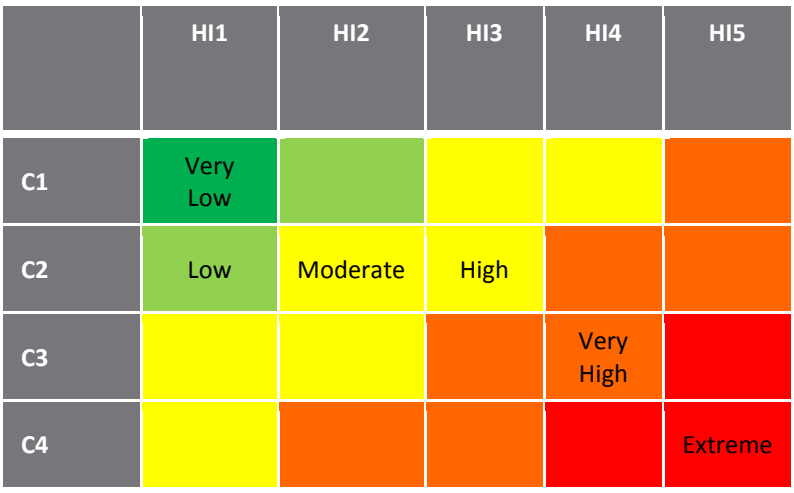


FIGURE 7 - RISK MATRIX

Health index bands are divided into five categories according to asset conditions:

HI Band	**Specification**
HI1	New or as New
HI2	Good or serviceable condition

HI3	Deterioration requires assessment and monitoring
HI4	Material deterioration, intervention requires consideration
HI5	End of serviceable life, intervention required

TABLE 3 - ASSET HEALTH INDEX BANDING

Consequences bands are divided into four categories according to asset condition

CI Band	**Specification**
CI1	'Low' criticality
CI2	'Average' criticality
CI3	'High' criticality
CI4	'Very High' criticality

TABLE 4 - ASSET CONSEQUENCES BANDING

3.6. Software Architecture

The architecture of the CNAIM software developed by EATL is illustrated in the diagram below. It is noted that asset condition data flows from left to right thus turning raw asset data (engineering, condition, specification) into an insight for reportable to Ofgem. CNAIM software operates in parallel with ENWL's existing CBRM software and operates using a similar principle.

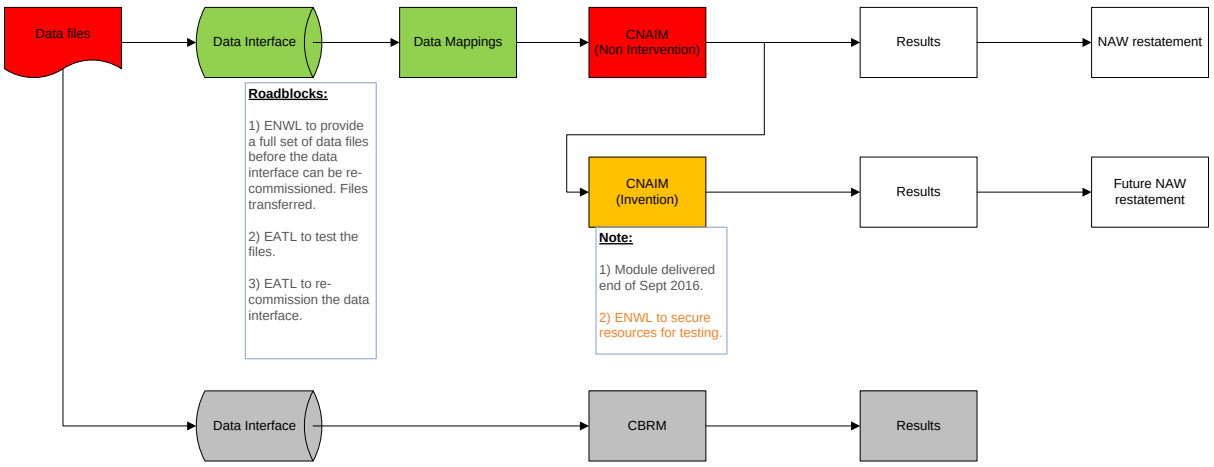


FIGURE 8 - CNAIM SOFTWARE ARCHITECTURE

The key modules (building blocks) of the software are:

Modules	**Key functions**
1) Data files loader	Enables data files with asset definitions and conditions data to be loaded into the system.

Modules	Key functions
2) Data mapping and calibration	Enable individual DNOs to calibrate the models.
3) CNAIM calculation engine	A calculation engine as per the methodology outlined in CNAIM document.
4) Reporting	A reporting function provides the calculated output into 5x4 risk matrices based on asset category. The reporting function has a prediction function to calculate asset conditions for future years.
5) CNAIM intervention module	Add-on intervention function enabling asset risk to be calculated when applying with intervention mechanisms.

TABLE 5 - KEY ELEMENTS IN CNAIM SOFTWARE ARCHITECTURE

3.7. Software Testing Methodology

As part of the project, a test methodology to commission the software was developed based on a number of critical checkpoints to ensure the software meets the specifications in terms of its functionality and overall stability. Significant effort has been invested into this phase of the project to ensure that the resultant outputs conform to the calculation formulae and theory outlined in CNAIM. A detailed insight is to be provided in the future quarterly reports.

3.8. Calibration of CNAIM asset models

ENWL has an established framework to collect asset data for input into their existing CBRM asset models known as Condition Data Capture (CDC) through a number of question sets for various asset class. These question sets are issued electronically though operational staff's iPhone based on a predefined asset inspection or planned maintenance requirements. One of the challenges present in the implementation process is to integrate exiting asset condition data and align them with the new CNAIM conditions points. A general concept is shown in the figure below.

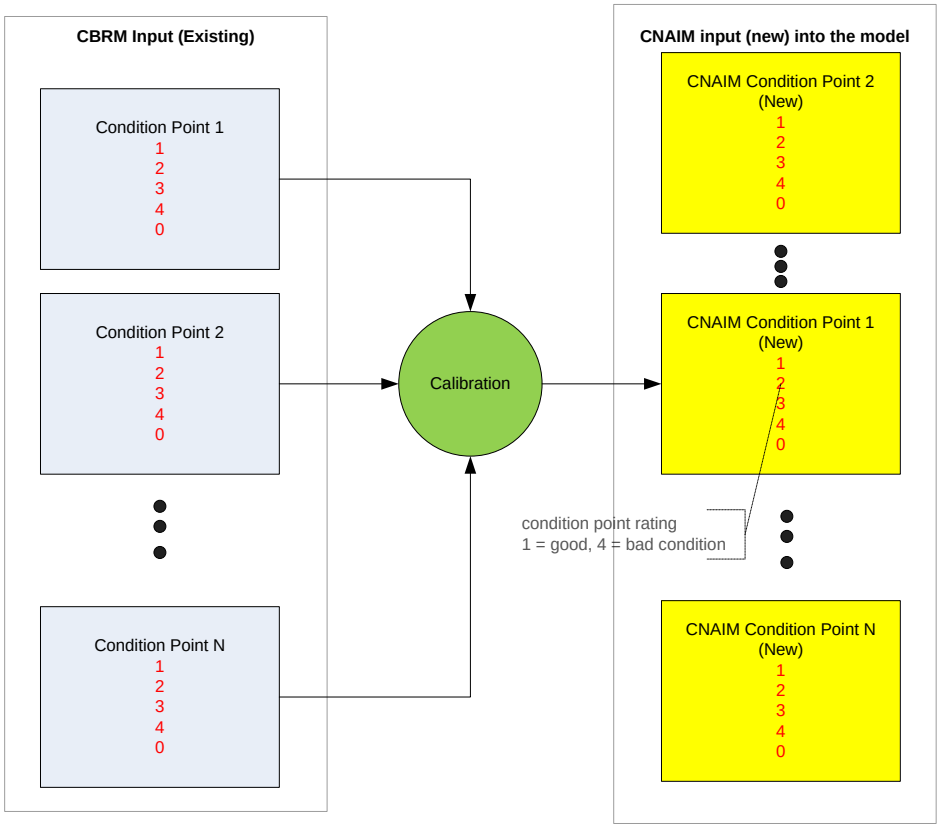


FIGURE 9 – EXISTING ASSET CONDITION DATA INPUTS MAPPING TO NEW CNAIM INPUTS

An example using two existing observed conditions of an asset category LV underground link boxes (UGB) is illustrated:

a) Existing input into CNAIM model:

Condition rating	CBRM input LK.LK.05.002 Cover Condition	CBRM input LK.LK.05.003 Pit Condition
1	Satisfactory	Satisfactory
2	Inspection Suspended	Repairs Required
3	Damaged but FFP	Blocked - No Access
4	Dmgd & Dnger to Pub	Inspection Suspended

TABLE 6 - EXAMPLE OF ASSET CONDITIONS INPUTS

b) Existing inputs are to be mapped to the new CNAIM methodology according the table below. CBRM data points LK.LK.05.002 and LK.LK.05.003 are mapped into the Observed Condition Input point 1 (Steel Cover and Pit Condition).

Asset Category	Subcomponent	Observed Condition Input
LV UGB	N/A	**1. Steel Cover and Pit condition** 2.Water/Moisture 3. Bell Condition 4. Insulation Condition 5. Signs of heating 6. Phase Barriers

TABLE 7 - EXAMPLE OF CNAIM OBSERVED CONDITION INPUTS

The inputs into the Observed Condition Input point 1 (Steel Cover and Pit Condition) are then turned into a new condition rating 1, 2, 3 or 4 which equates to level of asset deterioration condition and scores. The table below illustrates an observed condition input of steel cover and pit condition for LV UGBs.

Condition Rating	Condition Criteria: Observed Condition	Description
1	As New	No observed deterioration
2	Normal Wear	The asset component is fit for continued service. There is little deterioration
3	Some Deterioration	e.g. Minor corrosion
4	Substantial Deterioration	e.g. Major corrosion
	Default	No data available

TABLE 8 - EXAMPLE OF CNAIM OBSERVED A CONDITION INPUT CONDITION MAPPING

c) The table below provides a summary of the mapping of two existing CBRM inputs into a single CNAIM inputs feeding into the software calculation module.

CBRM Input	CBRM Input	CNAIM Mapping
LK.LK.05.002	**LK.LK.05.003**	**Table 34**
Cover Condition	**Pit Condition**	**SteelCover_PitCondition**
1	1	As New
2	1	Normal Wear
3	1	Some Deterioration
4	1	Substantial Deterioration
NULL	1	As New
1	2	As New
2	2	Normal Wear
3	2	Some Deterioration
4	2	Substantial Deterioration
NULL	2	Normal Wear
1	3	Some Deterioration
2	3	Some Deterioration
3	3	Some Deterioration
4	3	Substantial Deterioration
NULL	3	Some Deterioration
1	4	Substantial Deterioration
2	4	Substantial Deterioration
3	4	Substantial Deterioration
4	4	Substantial Deterioration
NULL	4	Substantial Deterioration
1	NULL	As New
2	NULL	Normal Wear
3	NULL	Some Deterioration
4	NULL	Substantial Deterioration
NULL	NULL	Default

TABLE 9 - EXAMPLE OF EXISTING CONDITION MAPPING TO CNAIM

This example illustrates a two-to-one situation where two existing data points are mapped into a single observed condition stipulated by CNAIM. Other mapping scenarios are one-to-one and many-to-one which

require significant efforts by the team to effectively devise a new "asset conditions converter" to accomplish the activity above.

3.9. The Way Forward

I find this project very useful for my professional development as it provides me with opportunities to build relationships with ENWL's key players. The project has a potential to transform the UK power industry through a fair comparison of their asset risks and investment efficiency. I look forward to embarking on the next steps of this project to commission the software, restate NAW and integrate the software into the business (phase 2 implementation).

4. Underground Link Boxes Asset Management Strategy

4.1. Background

Numerous disruptive failures of LV underground link boxes (UGB) have been reported across the UK and the number has been increasing since 2010, predominantly in the London area. Disruptive failure is defined as a fault or defect where energy is expelled which presents a high risk to the public as well as the asset owners' operational staff. Due to the high volume of UGBs being utilised across the UK, the failure mode is a significant national concern and is being closely monitored by the UK Health and Safety Executive (HSE). The issue has been discussed nationally by all six UK DNOs.

Through forensic examination carried out on failed UGBs by an engineering consultancy, it is concluded that the main cause of failure is due to ingress of water. ENWL has around 18,000 UGBs, and each of which has the potential to fail and cause harm. Although the likelihood of a UGB failing disruptively and causing harm to the public is very low, the consequences through possible injuries to the general public can potentially be serious.

In 2015 ENWL published a Code of Practice (CoP) describing the asset strategy to ensure that UGBs are managed in accordance with the relevant legislation and the principles of achieving safety, providing reliable service, as well as achieving a sustainable outcome. In 2016 ENWL has initiated a review of the strategy with a view to incorporate critical information received by an external report which has identified that UGBs over 50 years of age are deemed as "significant risk" of failures.

During the previous three months, I had an opportunity to work with ENWL's Asset Management and Standards and Policy business functions to develop an asset management strategy to prioritise 18,000 UGBs based on their potential risks. This section presents the highlights of the developed asset management strategy to address the safety issue with UGBs and identify the most cost effective risk mitigation model.

4.2. Asset Management Strategy

During the planning phase a solution architecture was developed based on a number of key criteria upon which UGBs may disruptively fail. These criteria include UGB configurations, age and footfall score.

UGB Intervention Strategy Matrix							
Configurations (No. of Ways)	Age						Footfall Score H = High L = Low
	≥50		49-26		≤25		
4	*	[3A]	*	[2A]	*	[2A]	H
	*	[2A]	*	[1]	*	[1]	L
2	*	[3A]	*	[2A]	*	[2A]	H
	*	[2A]	*	[1]	*	[1]	L

TABLE 10 - UGB INTERVENTION STRATEGY MATRIX

Note * *indicates the quantities in the table have been omitted on purpose.*

The intervention strategy matrix enables ENWL to:

- Allocate 18,000 UGBs in different category of solutions based on risk for deployment over the course of RIIO-ED1 (2015 to 2023).

- Ensure that the program is financially viable and is within the allocated safety initiatives budget.
- Demonstrate a robust evidence to HSE of a considered asset management programme.

Three feasible solutions were scoped during the analysis with a varying degree in costs and effectiveness detailed in the table below:

Intervention Options and Unit Cost				
Intervention Options		Options	Unit Cost	Operational
[1]	Inspection = Visual Inspection + Tighten	[1]	Low	
[2]	Blast Mitigation	[2]		
[2A]	Lytag Bag	[2A]	Low	Y
[2B]	Fire Blankets	[2B]	Low	Y
[3]	Replace = Renew or Joint out	[3]		
[3A]	Replace	[3A]	Very high	Y
[3B]	Joint out	[3B]	High	
[3C]	Lytag fill	[3C]	Moderate	

TABLE 11 - UGB INTERVENTION OPTIONS

Note: unit costs have been omitted on purpose

4.3. Footfall Model

A model named "footfall" has been developed to quantify and measure the likelihood of population potentially in proximity of a UGB. The model is based on the local surrounding environment and duration of that population density being in close proximity to the asset. A number of key indicators have been developed and mapped to the asset based on their distance to the asset. The table below illustrates various environments and four categories of distance or zones which yield the relevant exposure time and weighting to be used in the prioritisation scores.

Location	Distance (m.)	Footfall priority rating	Exposure time (% of a day)	Weighting
Bus stops	0-5 5-10 10 – 20 >20	V H M L	75	1
Food outlets	0-5 5-10 10 – 20 >20	VH H M L	30	2
Schools	0-50 50-150 150 – 300 >300	VH H M L	20	0.75
Other locations: universities, railway stations, places of worship, public car parks and shopping centre. Risk rating: VH = Very High, H = High, M = Medium and L = Low				

TABLE 12 - FOOTFALL MODEL

4.4. UGB Prioritisation Model

The overall UGB prioritisation model is derived from combination of key deciding factors which includes footfall score, asset age and proposed intervention solution. Effectively the stipulated factors are prioritised by bandings and the overall results are summarised a risk band per investment (intervention option) category as shown in the table below.

Investment Analysis per Risk Band						
Description	No.	Risk Level	Option	Qty	Unit Cost £	Sub-total £
4W->=55-H	1	VH	[3A]	713	*	*
2W->=55-H	2	VH	[3A]	620	*	*
4W->=55-L	3	H	[2A]	4056	*	*
2W->=55-L	4	H	[2A]	4193	*	*
4W-54-33-H	5	M	[2A]	237	*	*
2W-54-33-H	6	M	[2A]	291	*	*
4W-=<32-H	7	M	[2A]	350	*	*
2W-=<32-H	8	M	[2A]	563	*	*
4W-54-33-L	9	L	[1]	1016	*	*
2W-54-33-L	10	L	[1]	1811	*	*
4W-=<32-L	11	VL	[1]	1415	*	*
2W-=<32-L	12	VL	[1]	3013	*	*
					Total Investment £	*

TABLE 13 - INVESTMENT ANALYSIS PER RISK BAND

Note: *Unit cost, sub-total and total investment costs have been omitted on purpose.

4.5. The Way Forward

The project has provided an insight into how a leading asset manager tackles asset safety issues based on sound engineering solutions and supported by good commercial practices. During the next quarter, I envisage to provide updates and more insight into the project on the following aspects:

- Program deployment and efficiency assessment.
- Engineering testing of the proposed intervention solution to firm up its effectiveness.
- Integrating the proposed strategy with predictive asset conditions and risks of UGBs based on CNAIM.

5. Business Operations

During the course of my first three months, I have had opportunities to observe how ENWL operates as a business from an asset management function perspective. I draw a number key learning as follows:

- It is a very interesting period to observe ENWL undergoing a business transformation process. Road show sessions by ENWL's new CEO have been organised at all business locations to build new relations with all team members across the business.

- The message of safety has been heavily linked with affordability and reliability aspects of the business, thereby providing a sustainable business approach. Safety and team brief packs are well communicated to staff through the wider leadership team to ensure messages are understood by all team members.

- There is a major emphasis on the company's performance benchmarking with other UK DNOs within customer service area, thus firming up a customer centric focus in the UK power industry. This is a significant area of improvement in which Australia's power industry also strives to improve.

- Dissemination of knowledge using a structured method is very apparent throughout the business. ENWL has a unique model where the representatives across the business are required to submit a summary on their external appearances (meeting with key external stakeholders, forums, conferences etc) and share the knowledge amongst interested members. Any members across ENWL can subscribe to the mailing list. This is a very transparent and innovative knowledge-based building and dissemination approach.

- ENWL strives to play on its key strength in the area of innovation. ENWL has established a robust innovation strategy and led many successful innovation projects through its Future Network business unit. ENWL is also hosting the Low Carbon Network Conference in October 2016, a flagship conference in the UK power industry, thus demonstrating its commitments to be at the forefront of the power industry through an innovative mindset.

- I had an opportunity to attend a “Directorate Away Day” for the Network Strategy & Technical Services Directorate. This is a very innovative approach in cross-pollinating relationships amongst all staff (>280) across the directorate as well as ensuring that all team members understand their work are linked to their peers. Each core function in the directorate was tasked to present a short introduction through either an interactive activity or presentation on how it fits into the wider business. The photos below illustrate Asset Management Team members presenting the concept of asset life cycle.

FIGURE 10 - ENWL'S DIRECTORATE AWAY DAY

6. Extracurricular Activities

During the course of the scholarship placement, I took the opportunity to work on a number of extracurricular projects and attend conferences based in Europe. The highlights are detailed below:

- **CIGRE Paris Session**

  The 46th CIGRE Session was held in Paris, France during the 22-26th August 2016. It is a world leading conference and exhibition for power systems experts and leaders involving over 3000 delegates from around the world. I had an opportunity to join the Australian delegates at the conference and learn many aspects of the CIGRE inner workings as well as topical industry challenges. It was a great experience to join the CIGRE young representatives from Australia and other countries through various activities including hosting the Young Members (YMs) booth, attending technical forums, a site visit and professional networking events. I also took the opportunity to join CIGRE Next Generation Network UK to further strengthen relationships.

FIGURE 11- CIGRE PARIS SESSION

Photos: Site visit at 225kV Gambetta Substation in Paris organised by Réseau de Transport d'Électricité (a French power transmission company) and the CIGRE 46th Paris Session Young Members booth.

- **EATL 50th Anniversary**

  I attended EA Technology Limited 50th Anniversary function. I had an opportunity to learn many aspects of their business, products, services, expertise and their vision on the power industry of the future. The main theme projected by EATL is that innovation has been the key driver which kept the company at the forefront of the industry during the past 50 years. It was also made clear that good engineering with strong commercial practice is key to their future.

FIGURE 12 - EA TECHNOLOGY 50TH ANNIVERSARY

- **CIGRE Working Group C1-34 (Asset Management)**

  During the Paris session, I participated in WG C1-34 meeting to discuss the project progress and way forward to build a collective knowledge in the application of ISO55000 series of standards in an electrical utility context. The working group covers the following study areas:

  a) Overview of Asset Management principles, and a comparison of PAS55 and ISO55001.
  b) ISO55001 implementation guidelines.
  c) Shared self-assessment against ISO 55001 requirements and survey.
  d) Identification of specific requirements for IT tools for provision of ISO55001 relevant data and information.

  I envisage to provide updates and learning from the working group in the future quarterly reports.

FIGURE 13 - CIGRE WG C1-34 REPRESENTATIVES

- **Institute of Asset Management (IAM) NxtGen**

  To compliment my scholarship mission, I have joined IAM NxtGen UK Chapter with a view to leverage the learning from other asset management experts in the UK. Key learning will be provided in the future reports.

7. Conclusion and Moving Forward

Being part of ENWL's asset management team to work on multiple projects provided me with an excellent opportunity to understand how ENWL operate as a business. I have met numerous leaders and subject matter experts across the business and envisage to build a long lasting relationship with them for mutual benefit in the future. I have been introduced to many business processes, structures and leadership styles. During a relatively short period of time through observation, I am forming the belief that ENWL is a leader in the field of asset management through their deep knowledge and innovative mindset. During the second quarter, I plan to continue to contribute to the team delivering their business objectives with specific focus in the following areas:

- ISO 55001 surveillance audits – to gain insight into many aspects of ENWL's asset management discipline through many business functions.

- CNAIM phase 1 project implementation - model development, software testing, commissioning and submission of report to Ofgem.

- UGB asset management strategy – integration of the risk-based model with asset conditions, testing of solutions and deployment.

- International Electrotechnical Commission 80th General Meeting – preparation to attend the IEC General Meeting and leading the IEC 2016 Young Professionals (YPs) Programme workshop in Frankfurt, Germany.

- International Cooperation for Education about Standardization (ICES) – preparation to present along with two representatives from Japan and UAE as their keynote speakers on young leaders' perspectives on standardisation and the next generations of experts.

- Winter preparedness work – gain a better understanding of ENWL's flood management strategy and their emergency response plan for the upcoming winter season. Leverage the learning from last year's flood in the North West region of England.

- Site visits with field-crews across the ENWL's network.

In conclusion, I have learnt about many aspects of the UK power industry and I am looking forward to making the most out of the second quarter of my scholarship placement.

8. Acronyms

ACRONYMS	DESCRIPTIONS
AM	Asset Management
CBRM	Condition Based Risk Management
CDC	Condition Data Capture
CIGRE	International Council on Large Electric Systems
CNAIM	Common Network Asset Indices Methodology
COF	Consequence of Failure
COP	Code of Practice
DNO	Distribution Network Operator
EATL	EA Technology Limited
ENWL	Electricity North West Limited
FTES	Full-Time Employees
GEMA	Gas and Electricity Markets Authority
GWH	Gigawatthour
HSE	UK Health and Safety Executive
IEC	Internatinal Electrotechnical Commission
ISO	International Organization for Standardization
KM	Kilometer
KV	Kilovolt
LV	Low Voltage
MV.A	Megavolt amperes
NTTS	Network Strategy & Technical Services (NTTS)
OFGEM	Office of Gas and Electricity Markets
OHL	Overhead Line
POF	Probability of Failure
RIIO	Ofgem's price control framework first implemented in 2013
RIIO-ED1	1st price control for electricity distribution companies under the RIIO framework
SLC	Standard Licence Condition
UGB	Low Voltage Underground Board (Link Box)

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